REMARKS

Claims 1-29 are pending in this application, of which claims 1, 18, 20, 22 and 28 are independent.

Claims 1, 18, 20 and 22 are amended to include language that clarifies the dissipation of heat away from the semiconductor die. Support for these amendments can be found in at least paragraphs [0019-23], [0031], [0033] and [0035-36]; see also FIGs. 1, 5, 7 and 9.

Claims 17 and 29 are amended to correct spelling errors.

Paragraphs [0025] and [0033] of the specification are amended to correct spelling errors.

No new material is added.

Claim Rejections 35 U.S.C. § 102

Claims 1, 2, 4-6, 8, 12 and 18-25 stand rejected under 35 U.S.C. §102(e) as being anticipated by U.S. Patent No. 6,976,527 to Kirshberg et al. (hereinafter "Kirshberg"). Respectfully, we disagree.

As way of background, the immediate application teaches of a thermosyphon system that has a semiconductor die 12 coupled to a condenser 14. The condenser 14 is not part of semiconductor die 12. Microchannels 18 are formed into a substrate of die 12 to form an "evaporator" and are connected via an input fluid conduit 16A and an output fluid conduit 16B to condenser 14, to form a closed-loop fluid pressure volume for a fluid 20. See paragraphs [0019] and [0020] of the specification and FIG. 1 of the drawings. Clearly, fluid 20 transfers heat away from die 12 through operation of the thermosyphon system.

On the other hand, Kirshberg discloses a microcapillary pumped loop that "is fabricated using at least two substrates as shown in FIG. 3 with a first substrate shown in FIG. 3A etched to form evaporator 10, condenser 12, vapor line 14, and liquid line 16 and posts 28." See Kirshberg col. 2, lines 61-65. Since the condenser is etched into the same substrate as evaporator 10, the microcapillary pumped loop of Kirshberg moves heat from one part of the substrate to another, relying upon an "outside heat

sink" to exchange heat away from the condenser. See Kirshberg col. 2, lines 52-54. Therefore, the fluid of Kirshberg does not transfer heat away from substrate 21.

To anticipate a claim, Kirshberg must teach every element of the claim and "the identical invention must be shown in as complete detail as contained in the ... claim." MPEP 2131 citing Verdegaal Bros. V. Union Oil Co. of California, 814 F.2d 628, 2 USPQ2d 1051 (Fed. Cir. 1987) and Richardson v. Suzuki Motor Co., 868 F.2d 1226, 9 USPQ2d 1913 (Fed. Cir. 1989). Kirshberg does not teach every element of claims 1, 2, 4-6, 8, 12 and 18-25.

Amended claim 1 recites a loop thermosyphon system, including:

a) a semiconductor die having a plurality of microchannels;

b) a condenser in fluid communication with the microchannels; and

c) wicking structure to wick fluid from the condenser to the semiconductor;

d) wherein the fluid dissipates heat away from the semiconductor die.

Kirshberg does not disclose a semiconductor die with a plurality of microchannels as required by element a) of claim 1. As taught by paragraphs [0027-28] of the immediate specification, semiconductor die 12 operates as the system "evaporator." That is, the evaporator is formed of microchannels 18 etched into semiconductor die 12. FIGs. 3-9 of the immediate application clearly show microchannels 18 etched into semiconductor die 12. Although Kirshberg discloses grooves 24, these grooves are not equivalent to microchannels 18 of the immediate application. Kirshberg instead discloses that "a plurality of grooves 24 ... form a wicking structure," "with the wicking structure coupling the evaporator 10 to liquid line 16 and reservoir 18." See Kirshberg col. 2, lines 48-52. Further, grooves 24 of Kirshberg are etched into a second substrate 22 (see at least Kirshberg FIGs. 3 and 4), which is not equivalent to semiconductor die 12 as required by element a) of claim 1.

Although Kirshberg uses the term "wicking structure" in connection with grooves 24, Kirshberg discloses that grooves 24 "form a wicking structure for conversion of liquid to a vapor in the heat exchanger and with the wicking structure coupling the evaporator to liquid line 16 and reservoir 18." Thus, the wicking structure of Kirshberg does not operate as a wicking structure to wick fluid from the condenser to the semiconductor as required by element c) of claim 1. Element d) of claim 1 requires that heat is transferred away from the semiconductor die by the fluid.

As noted above, Kirshberg does not disclose the use of a fluid to transfer heat away from the semiconductor die.

For at least these reasons, Kirshberg cannot anticipate claim 1. Reconsideration of claim 1 is respectfully requested.

Claims 2, 4-6, 8 and 12 depend from claim 1 and benefit from like argument. These claims also have additional features that patentably distinguish over Kirshberg. For example, claim 2 recites an input fluid conduit for coupling fluid from the condenser to the semiconductor die, the wicking structure being internal to the input fluid conduit. As argued above, the wicking structure of Kirshberg does not couple between the condenser and the semiconductor die and is not internal to the input fluid conduit since it is formed upon a second substrate only. Claim 4 recites a plate coupled with the die to seal the microchannels such that fluid flows through the microchannels. As argued above, the microchannels of Kirshberg are etched into the plate and not the die. Claim 5 recites fluid selected from the group consisting of water, Fluorinert and alcohol. Kirshberg provides no disclosure on the selection of a suitable fluid. Claim 8 recites that the wicking structure comprising thermally conductive material. As argued above, Kirshberg does not disclose a wicking structure. Claim 12 recites that the microchannels are shaped for preferential fluid flow along one direction of the microchannels. See for example FIG. 9 of the drawings and paragraph [0035] of the specification, which clearly illustrate shaped microchannels 18. Kirshberg makes no disclosure of shaped microchannels.

For at least theses reasons claims 2, 4-6, 8 and 12 cannot be anticipated by Kirshberg. Reconsideration of claims 2, 4-6, 8 and 12 is respectfully requested.

Amended claim 18 recites a loop thermosyphon system, including:

a) a semiconductor die having a plurality of microchannels, one or more of the microchannels being shaped for preferential fluid flow along one direction of the die; and
b) a condenser in fluid communication with the microchannels, to cool heated fluid from the die for input to the microchannels;
c) wherein the fluid dissipates heat away from the die.

As argued above, Kirshberg does not disclose a semiconductor die with microchannels as required by element a) of claim 18. Further, Kirshberg does not disclose that the microchannels are shaped for preferential fluid flow along one direction of the die. See for example paragraph [0035] of the specification and FIG. 9 of the drawings, which show microchannels 18(3) shaped for preferential fluid flow along one direction. Teaching away from element c) of claim 18, the microcapillary pumped loop of Kirshberg moves heat from one location on a substrate to another; it does not transfer heat away from the die.

For at least these reasons, Kirshberg cannot anticipate claim 18. Reconsideration of claim 18 is respectfully requested.

Claim 19 depends from claim 18 and benefits from like argument. Claim 19 also includes features that patentably distinguish over Kirshberg. For example, claim 19 recites that the wicking structure is arranged between the condenser and the die, to wick fluid from the condenser to the microchannels. As argued above, the wicking structure of Kirshberg is not equivalent to that of claim 19, since it does not couple the condenser and the microchannels (i.e., the evaporator).

For at least these reasons, Kirshberg cannot anticipate claim 19. Reconsideration of claim 19 is respectfully requested.

Amended claim 20 recites a loop thermosyphon system, including:

a) a semiconductor die having a plurality of microchannels;
b) at least one orifice at an input to at least one of the microchannels, for preferential fluid flow along one direction of the at least one microchannel; and
c) a condenser in fluid communication with the microchannels, to cool heated fluid from the die for input to the microchannels;
d) wherein the fluid dissipates heat away from the die.

As argued above, Kirshberg does not disclose a semiconductor die having a plurality of microchannels as required by element a) of claim 20. Further, Kirshberg does not disclose at least one orifice at an input to at least one of the microchannels for preferential fluid flow along one direction of the at least one microchannel as required

by element b) of claim 20. Again, as argued above, the heated fluid of Kirshberg does not transfer heat away from the die as required by element d).

For at least these reasons, Kirshberg cannot anticipate claim 20. Reconsideration of claim 20 is respectfully requested.

Claim 21 depends from claim 20 and benefits from like argument. Claim 21 also has other features that patentably distinguish over Kirshberg. For example, claim 21 recites that a wicking structure is arranged between the condenser and the die, to wick fluid from the condenser to the microchannels. As argued above, the wicking structure of Kirshberg is not equivalent to the wicking structure of the immediate application and does not couple the condenser to the die.

For at least these reasons, Kirshberg cannot anticipate claim 21. Reconsideration of claim 21 is respectfully requested.

Amended claim 22 recites a method of cooling a semiconductor die, including:

a) wicking fluid from a condenser, for input to one or more microchannels of a semiconductor die;
b) communicating heated fluid from the die to the condenser; and
c) cooling fluid at the condenser;
d) wherein the fluid transfers heat away from the semiconductor die.

As argued above, Kirshberg does not disclose microchannels and therefore cannot anticipate step a) of claim 22. Again, as argued above, Kirshberg does not teach or suggest that the fluid transfers heat away from the semiconductor die as required by step d).

For at least these reasons, Kirshberg cannot anticipate claim 22. Reconsideration of claim 22 is respectfully requested.

Claims 23-25 depend from claim 22 and benefit from like argument. These claims also have additional features that patentably distinguish over Kirshberg. For example, claim 23 recites utilizing an input fluid conduit, containing the wicking structure, between the condenser and the semiconductor die. Claim 24 recites utilizing an input header, containing the wicking structure, between the input fluid conduit and the microchannels. As argued above, the wicking structure of Kirshberg is not the

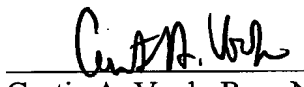
same as the wicking structure of the immediate application and is not located within the input fluid conduit between the condenser and the semiconductor die. Further, as admitted by the Examiner in paragraph 5 of the pending office action, Kirshberg does not disclose an input header. Claim 25 recites shaping the microchannels for preferential fluid flow along the microchannels. Kirshberg make no disclose of shaped microchannels.

For at least these reasons, Kirshberg cannot anticipate claims 23-25. Reconsideration of claims 23-25 is respectfully requested.

Examiner's indication of allowable subject matter is appreciated. In view of the above amendments and remarks, we solicit allowance of claims 1-29.

Applicants believe no fees are due in connection with this response. If any fee is due, please charge Deposit Account No. 08-2025.

Respectfully submitted,

By: 

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